The Best Jumper Points Design of the Sewing Machine

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Abstract

This article uses the principle of Wavelet transformation and Quad-tree structure to find the best jumper points of embroidery machine. Embroidery want the image to be cut into four equal parts. Furthermore, to judge each part if there exist two object for connection jumper point selection. For special case, the four parts divided will be extended until the best jumper point were found. According to the simulation results, our method is evidently an effective and high quality method for sewing machine for embroidering purpose.

Keywords

Sewing Machine; Quad-tree; Jumper Points; Image Processing

Introduction

The performance of the textile industry has increased steadily in recently years. For example, the total revenue are 14.158 billions, 15.123 billions, 15.866 billions and 17.91 billions in 2012, 2013, 2014 and 2015, respectively. The sales amount is positive growth, it is expressed as an increase in garment manufacturing time. If we can reduce the working time, the company's production capacity can improve. It can also increase the company's profit.

Path planning will be used in the sewing machine for embroidering. This technique can improve the efficiency of sewing machines. Chen et. al. [1] published an article *Image-Based Obstacle Avoidance and Path-Planning System* and Rigasova [2] proposed the Path planning algorithm based on search algorithm, edge detector and GPS data/Satellite image for outdoor mobile systems are offer the information about the path planning studies. Other related path algorithm can refer to [3-4]. According to the [5-8], it can be found these sewing techniques, but they did not discuss about the best connection points. In order to improve sewing techniques, we proposed the Quad-tree technique to accelerate the search time for searching the best connection jumper point of the sewing machine.

The Best Jump Point Algorithm

In this paper, we focus on the best connection jump point design for sewing machines. It is a part of the picture of sewing techniques. Figure 1 shows the flow chart of the best jump point design. At beginning, the color picture is entering to the system. And then the color segmentation was used to separate the picture into several parts which are the same color. In practical, the same color parts will be processed at the same time. Due to the fact that greyscale is suitable for the image processing. Therefore, we use the color to greyscale mapping to transfer the color picture into greyscale picture. Next, edge detection was used to obtain the edge of the picture. Once we get the edge and each color parts, we use the quad-tree technique to get the best jump point information. The sewing machine can achieve best efficient and best quality on the picture embroidering.
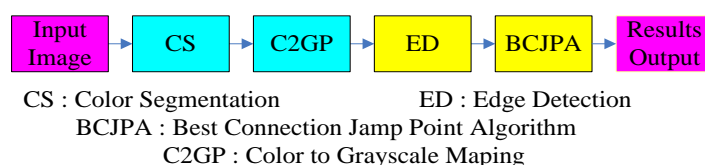

CS : Color Segmentation   ED : Edge Detection
BCJPA : Best Connection Jamp Point Algorithm
C2GP : Color to Grayscale Maping

FIG.1 THE BEST JUMP POINT ALGORITHM

Color Segmentation

Color segmentation was used to divide several same color parts from a picture. Figure 2 shows a test example. Figure 2(a) shows the test picture and figure 2(b) is the histogram which is corresponding to figure 2(a) in greyscale.

FIG. 3 displays the classified results. Figure 3(a) shows the class that the pixel value is 17 and figure 3(b) shows the pixel value is 55. Similarly the pixel value is 105, 112, 123 and 202 are the values correspond to figure 3(c), 3(d), 3(e) and 3(f) respectively.

In the paper, we use the concept of the wavelet techniques and Quad-tree structure to design a best connection jump point design.

According to the [9-10], the sewing step and sewing jumper points are on the edge, so to find the side track is important. In edge detection, we put the original picture and erosion operation to produce a good performance edge image. From the simulation result, it is superior to the Sobel operation or Canny edge detection.
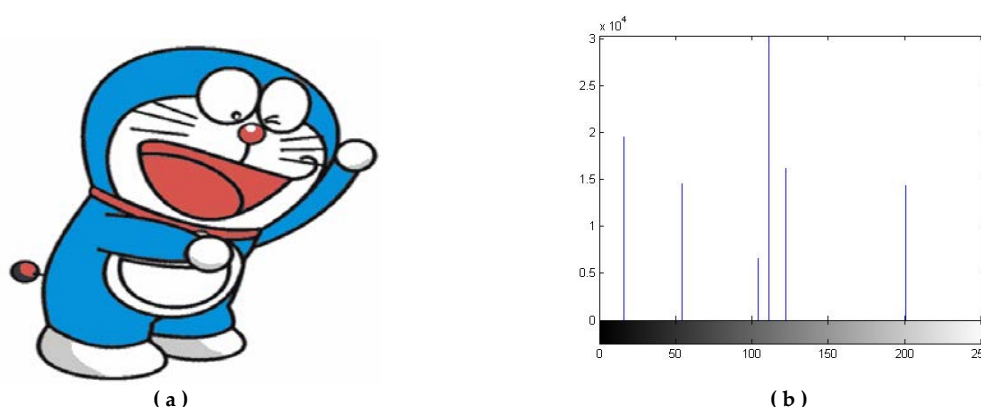

(a)   (b)

FIG.2 COLOUR SEGMENTATION; (A) THE TEST IMAGE (B) THE HISTOGRAM OF CLUSTERING

(a)   (b)   (c)

(d)   (e)   (f)
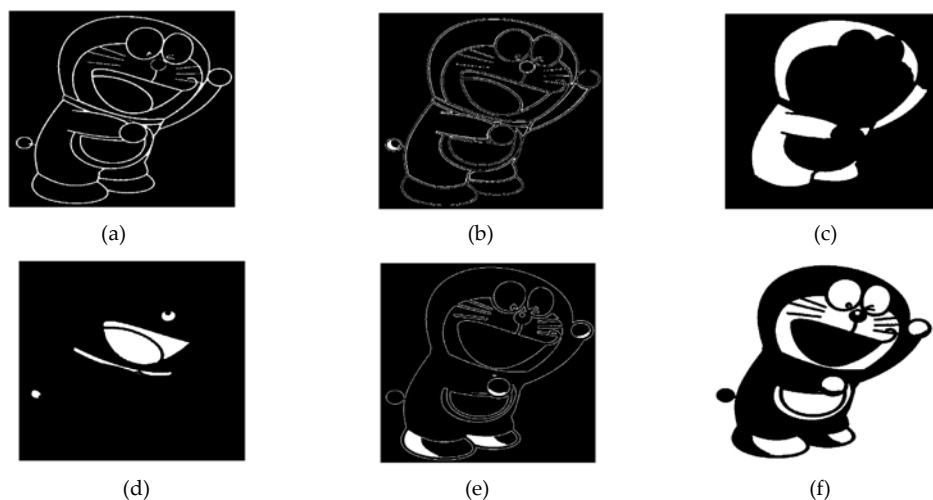
FIG. 3 THE CLASSIFIED RESULTS; (A) THE PIXEL VALUE IS 17, (B) THE PIXEL VALUE IS 55, (C) THE PIXEL VALUE IS 105, (D) THE PIXEL VALUE IS 112, (E)A THE PIXEL VALUE IS 123, (F) THE PIXEL VALUE IS 202

The Best Jump Point Search Method

A picture can be divided into several independent objects. When the sewing machine do embroider action, jumping to the other object is necessary. Thus search the best jump point is important. Figure 5 shows the best jump point situation for a picture. In the figure, the green points are the best jump points.

The wavelet concept divides the picture into four parts first. And then check each part if it includes two objects. If the answer is yes, then search the best jump points. If the part only has one object then the part can be discarded because there is no jump exists. FIG. 5 shows the process of dividing the picture into several parts for searching the

best jump points. Figure 5(a) is the original test picture. Figure 5(b) and figure 5(c) are the parts include two objects. Similarly, Figure 5(d) and figure 5(e) are the parts only have one object, it means no jump point needed.
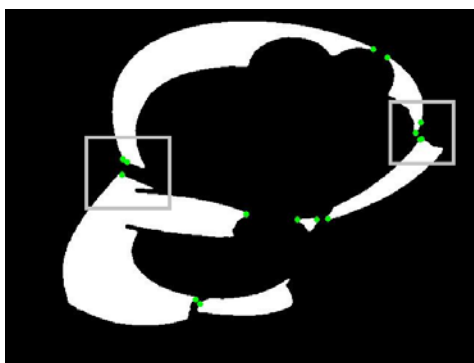

FIG. 4 THE SCHEMATIC OF THE BEST CONNECTION JUMP POINTS
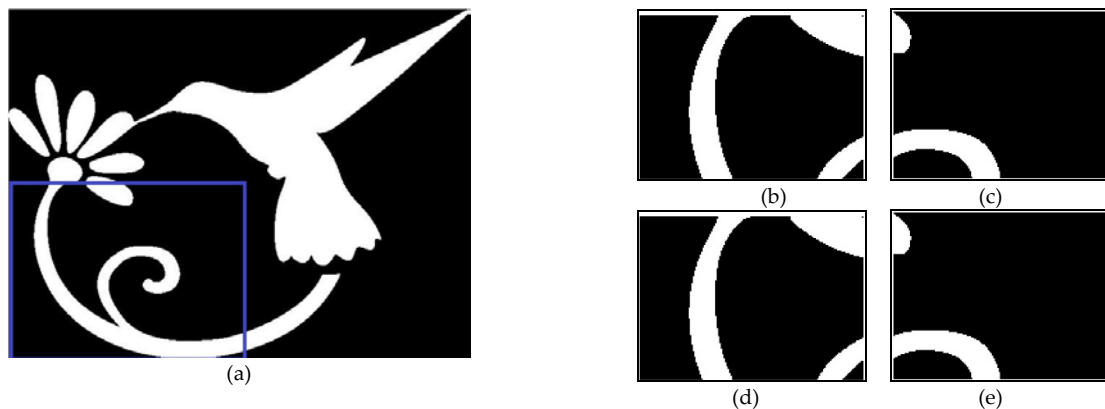

FIG. 5 THE PROCESS OF DIVIDING THE PICTURE INTO SEVERAL PARTS FOR SEARCHING THE BEST JUMP POINTS; (A) THE ORIGINAL PICTURE, (B) THE PART INCLUDE TWO OBJECTS, (C) THE PART INCLUDE TWO OBJECTS, (D) THE PART ONLY HAS ONE OBJECT, (E) THE PART ONLY HAS ONE OBJECT
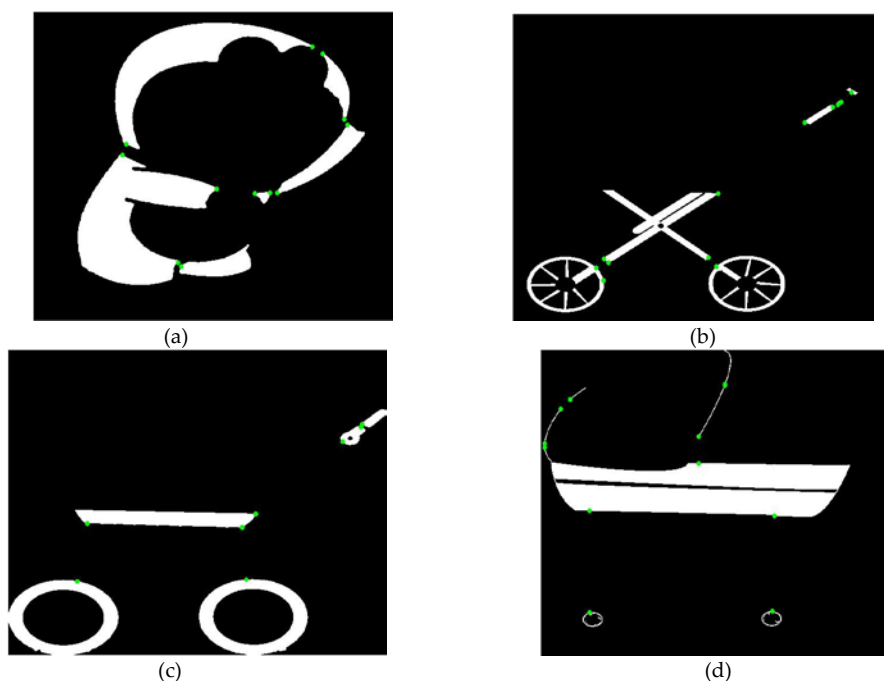

FIG.6 THE SUCCESSFUL TEST RESULTS; (A)CASE-1, (B) CASE-2, (C)CASE-3, (D)CASE-4

Experimental Results

In order to demonstrate that our method is effective and of high quality, several image are used to simulation.

From the simulation results it is evident that the wavelet based quad-tree structure is suitable for the sewing machine to find the best jump point search.

Figure 6 shows the successful test results of the best jump point design for the picture. Figure 6(a) is the best jump point design of the case-1 picture. Figure 6(b) shows another best jump design of the case two picture. Simultaneously, Figure 6(c) and figure 6(d) are the successful jump point design case of different pictures.

Conclusion

In this paper we use the shortest distance technique, the wavelet concept and Quad-tree structure to search the best jump points for sewing machine.

We use the wavelet concept to obtain a suitable jump point search. Besides, we use the Quad-tree structure to obtain a computation complicate. From the simulation results, it is demonstrated that our method obtain 29.9% ~ 55.6% computation reduce time

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